The Occultation Digital Tape Validation Program

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The Occultation Recording Assembly (ORA) located in the JPL Compatibility Test Area is used to produce 9-track computer-compatible digital magnetic tapes from analog occultation tapes recorded at one of three Deep Space Stations. In the past, the software has been used only to static check the ORA hardware configuration. This program allows the operator to validate the contents of the completed digital tapes before they are sent on for costly processing and analysis.

I. Introduction

During a spacecraft flyby of a planet, the spacecraft undergoes an occultation as it passes behind the planet. When this occurs, the signal transmitted by the spacecraft is affected as it passes through the planet's atmosphere. An analog recording of the signal can be made at selected Deep Space Stations. The recording is then taken to the JPL Compatibility Test Area (CTA 21) for conversion to a computer-compatible digital 9-track tape representation of the signal. The digital magnetic tapes are then taken to the Network Operations Control Center (NOCC) for analysis.

The Occultation Recording Assembly (ORA) in CTA 21 is used to produce the 9-track digital tapes from the analog recordings. In the past, the operator has been able only to static check the ORA hardware configuration. The Occultation Tape Validation Program allows the operator to do a more thorough verification of the contents of the completed digital tapes before costly and time consuming computer analysis is done.

II. Hardware

The program, along with the current occultation software, uses an Interdata-4 computer contained in the Occultation Recording Assembly. The Occultation Tape Validation Program makes use of two magnetic tape units for reading in the contents of the digital records and a teleprinter for communication with the operator. The recording process makes use of the analog-to-digital (A-D) channel. The program is controlled by a clock input of 40 kHz. Each clock impulse causes the input of one 6-bit sample from the analog-to-digital channel. A 42-bit time code generator is used to input time tags placed at the head of each digital record.

III. Current Software

The current occultation software consists of a test program and an operational program. The test program allows the user to check the magnetic tape setup, the time code input, and the analog-to-digital input. Thus, it verifies the ORA to computer link. The operational program writes the data onto a series of tapes in the form of 4106-byte records. The recording process is controlled by a clock input of 40 kHz. One record is created for each 4096 clock impulses, thus the records occur every 0.1024 seconds. Each record as shown in Fig. 1 consists of the following:

(1) Station ID code: 1 byte

(2) 42-Bit NASA time code: 9 bytes

(3) Digital data: 4096 bytes

IV. Program Description

The Occultation Tape Validation Program was created to validate the tapes produced by the operational program before being considered ready for data analysis. The program is divided into two separate test operations. They are:

(1) Tape file validation and search.

(2) Tape file dump.

The file validation is used to check the information written on a completed digital tape. This can be divided into four sub-operations:

(1) The program checks the time difference (Δ) between records for any pair or series of pairs by comparing it with an inputted Δ time value. The expected Δ time can be determined from the clock rate and the analog tape speed. Any errors result in a message giving the actual Δ time between records.

(2) The program checks the size of any or all records (this should be 4106 bytes). Any size errors cause the program to type out a message indicating the error and record number.

(3) The program checks the station ID code of any or all records. The ID is compared with the value used in the operational program.

(4) The program counts the total number of occurrences of given 8-bit patterns within each record. This can be used to check for 4096 occurrences per record of a pattern in a test tape. Since up to six 8-bit patterns can be counted at a time, this operation can be used to tally the distribution of sample points in a given record. This can be compared with the expected distribution within the records to provide a statistical verification of the data.

The tape file dump operation allows the operator to dump the partial contents of any specified record onto the teleprinter. The program continuously types 32 bytes/line until a control on the computer display panel is actuated.

V. Conclusions

This program has already proven valuable in discovering and fixing hardware failures. In one case a time code error produced by a failed time code bit was discovered and corrected. In another case, a periodic data error was located and corrected with the help of this program. Without this program these problems would have been detected during the costly 9-track data reduction and analysis procedure conducted by project experimenters.

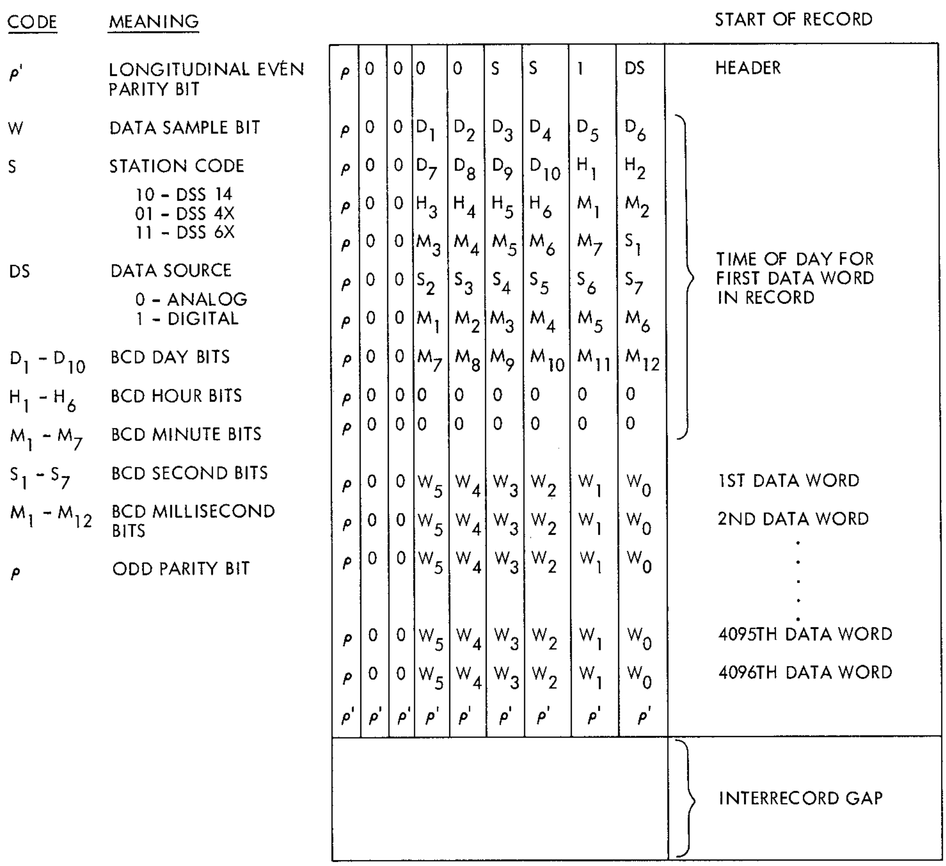

Fig. 1. Tape record format